The role of facilities management in green retrofit of existing buildings in the United Arab Emirates

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Abstract

Purpose – *Green retrofitting is acknowledged as an essential strategy towards achieving long term sustainability in the built environment. To implement this strategy successfully, the role of facility managers cannot be ignored. The purpose of this paper is to investigate present practices that are utilised in managing the existing facilities, to highlight the elements that govern the process of green retrofitting, and to discuss the efforts and contribution of facility managers in enhancing the environmental performance of the existing facilities stock in the United Arab Emirates (U.A.E.).*

Findings – *This study suggests that an adequate level of awareness of the benefits of green retrofit amongst owners and decision makers is mostly dependent on FM professionals, who must establish effective communication channel with senior management. FM professionals in the U.A.E are well equipped and competent in greening existing buildings and can simultaneously lead a building to the path of achieving green building certification.*

Methodology *– To examine the role of facilities management in a green retrofit and its current status in the UAE built environment,* a *two-step qualitative method was adopted. The study started by conducting semi-structured interviews with FM professionals and then assessing the insights obtained from the interviews against an actual case study of a LEED Existing Building certified facility.*

Research limitations *– Interviews were limited to FM professionals in the private sector and the results from one case study should be considered cautiously.*

Originality/value *– This paper emphasises the primordial role of FM professionals in promoting green retrofit in the UAE.*

Keywords: *Green retrofit, facilities management, LEED, operational stage, sustainability*

1. Introduction

For some time there has been considerable concern about the rising population that led to the "boom to bust" developments of infrastructure in the U.A.E. Amid growing concerns of global warming, developers have been seen to align their approach towards creating new sustainable communities based on legislative requirements and stakeholder

expectations. Where on one hand new sustainable developments are providing benefits such as increased rental incomes, an appreciating building value, and acquisition of prestigious LEED certifications and so on, then the existing building stock cannot be overlooked. With the operational phase being the longest of a building lifecycle, operating costs of conventionally designed buildings can be as high five times than its capital cost (McAuley, Hore and West, 2013).

Facilities Management (FM) is a discipline that encompasses both the strategic and tactical operations of a building with its objectives aligned in a bid to support the core business of the organization (Barrett and Baldry, 2003). Based on technical competencies, FM can enhance sustainability performance and decrease environmental impacts brought about by existing buildings through a process known as 'green retrofitting'. A definition by the U.S. Green Building Council (USGBC) states that, green retrofitting is "any upgrade of an existing facility to improve energy and environmental performance, decrease usage of water and enhance existing comfort and quality of interior spaces – all achieved in a manner that provides financial incentives to the investor" (Jagarajan *et al.*, 2017). This study aims to examine the overall process of green retrofitting and the role of facilities management in enhancing sustainability quo of the existing building stock.

2. Literature Review

2.1 The U.A.E. and its initiatives towards sustainable development

The United Arab Emirates (U.A.E.) is known to have a harsh environment with mean temperatures reaching up to 48 degrees Celsius and relative humidity as much as 70-90% (MOHAMED and BASEM 2015a). With the construction of a variety of buildings, the construction segment became the second highest contributor towards the gross domestic product of the U.A.E. in 2008 (Abu-Hijleh et al. 2017).

The U.A.E. over the past few years has taken significant policymaking efforts and devised sustainable building codes and standards. The inception of 'Estidama' – a sustainability initiative by the Abu Dhabi government in 2007, enforces developers to comply with specific mandatory criteria of sustainable development (Alkhateeb *et al.*,

2016). Similarly, the Dubai government formed the Green Building Regulations and Specifications (GBRS) (Fayyad and John, 2017). However the real challenge lies in operation of the existing building stock. Post the inception of 'Estidama', 70,000 residential properties were built in compliance with the stipulated guidelines and standards. However from the year 2015, the existing building stock remained at 185,000 properties that were constructed prior to the inception of 'Estidama'. The mandatory compliance with energy efficiency guidelines and legislations hence seem relatively new with minute control over the existing building stock (Assaf and Nour, 2015).

With new developments being created with the wisdom of sustainability, then the negative environmental consequences of existing buildings cannot be overlooked. Considering arid climatic conditions of the nation, a significant portion of electricity is expended for operations in the areas of HVAC (Heating, Ventilation, and Air conditioning), water consumption and lighting (Dubey and Krarti, 2017). Elmualim *et al.*, (2010) suggests that an existing building stock can account for up to 45% of electricity consumption during the operational phase in contrast to 5% of the electricity that it would have potentially consumed during the construction phase.

With reference to figure 1 below, residential and commercial building segments expended 32% and 36% respectively from the total electricity generated in 2013. From statistics released by the Abu Dhabi Environment Agency, the emirate accounted for an electricity consumption per capita of 20.39MWh/year which was equivalent to seven times the global average of 2.89MWh/year back in 2011 (Assaf and Nour, 2015).

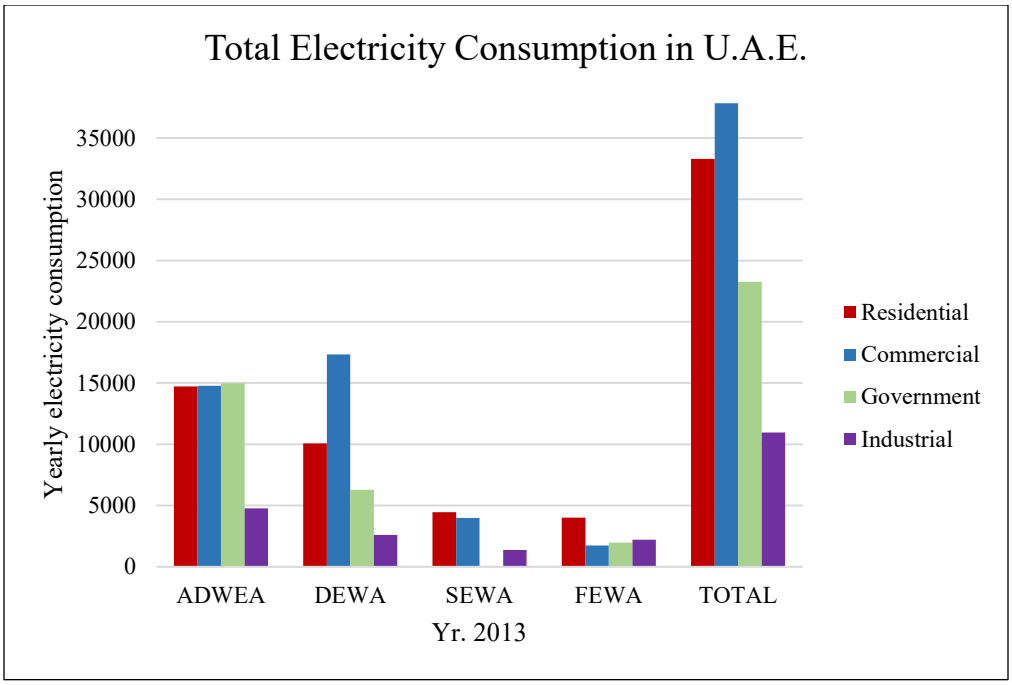

Fig. 1 – End-user electricity consumed (GWh) across all U.A.E. utility authorities (Dubey and Krarti, 2017)

With increasing need for sustainability and growing concern of environmental impacts, the existing building stock can be reused and adapted through a process known as 'green retrofit' which is believed to reduce existing energy consumption and greenhouse gas emissions (Navid and Folke, 2012).

The year 2013 witnessed Dubai Regulations and Water Authority (DEWA) propelling its efforts in forming Etihad Energy Services – an organization aiming to enhance energy consumption of 30,000 buildings from the existing stock of 120,000 buildings through 'green retrofitting' (Dubey and Krarti, 2017). Where private buildings of the U.A.E. are concerned, (MOHAMED and BASEM, 2015) suggest that to accomplish the desired health environment for Abu Dhabi vision 2030, 72% of the existing building stock must be retrofitted. This thus indicates that a bulk of buildings in the U.A.E. were developed with relatively low energy efficiency practices.

2.2 Green retrofitting

With increasing environmental and social concerns, an existing facility can remain in use by making it capable of complying with the social, economic and environmental pillars of a green building. Green retrofitting is an approach tailored to enhance existing operations and sustainability quo of a building. The process involves modifying current processes brought about by additions, removals or replacements of one or more components of the existing facility (Sanvido and Riggs 1991).

2.2.1 Benefits of green retrofitting

A green retrofit provides an opportunity to leverage sustainability of an existing building and provide benefits at a minimal cost that would otherwise be incurred through demolition and construction of a new facility (Dong et al. 2005).

Economic benefits

As suggested by (Dong, Kennedy and Pressnail, 2005), green retrofitting is usually less risky owing to the usage of limited materials as the structural components are already available. Through usage of green materials with 'low' churn rates, current performance standards of the asset can be optimized to therefore reduce breakdowns, retain and even potentially, increase the useful life of the asset (Mawed et al., 2014).

Environmental benefits

Traditional structures have a significant impact on the overall environment seen through carbon emissions brought about by materials used for the external envelope and within internal spaces. Hence if a new sustainable development seems desirable, then its construction can account for seven times the resources that would be required for an equivalent green retrofit (Power 2008). Likewise, (Metka et al. 2006) advocates that green retrofitting involves re-utilization of existing materials and minimizes the production of solid waste to hence preserve eco-system and urban biodiversity. The procurement of environmentally friendly materials through due consideration of a

lifecycle assessment enables both preliminary assessments of the performance of a building and maintenance costs that can be anticipated during the operational phase.

Health and community benefits

Thermal well-being, indoor air and environment quality levels have a direct impact on overall satisfaction and health of employees (Zuo and Zhao 2014). Based on a survey of over 200 employees conducted by (Hwang and Jeong, 2011), findings showed that visual comfort levels are directly dependent upon the indoor lighting levels. Similarly, findings of a survey conducted by (Abbaszadeh *et al.*, 2006) revealed the importance of good IEQ levels amongst occupants from 180 buildings. With respondents expressing contentment on adequate availability of natural sunlight, the ability to control indoor temperatures and improved ergonomics, green buildings were seen to outperform conventional buildings in terms of indoor conditions.

2.2.2 Drivers for green retrofitting

The drivers of a green retrofit are seen to stem from social, environmental and economic factors (Masrom et al. 2017). From an economic viewpoint, a green retrofit lowers level of energy use and operational costs to maximize savings and profits of an organization. Refurbishment with respect to social factors minimizes the impacts of an existing facility on its internal and external environment and hence preserve socio-cultural principles (Bhuiyan et al. 2015).

In 2017, Abu Dhabi government upped its efforts with the introduction of the "Tarsheed" program that will see energy services companies aiming to fund and undertake energy retrofits of existing government buildings with the invested capital recouped through the reduction in energy costs. Meanwhile in Dubai during the same year, a total of 243 buildings of Wasl Properties – a government-owned entity, underwent green retrofit at the cost of AED 69 million. The project is expected to yield yearly energy savings of up to AED 15 million (Pillai, 2017). Stephan Le Gentil, CEO of Etihad ESCO, suggests that most private building owners are seen to only implement negligible-to-low cost energy conservation initiatives without reaping the actual benefits of retrofitting (Surendar, 2016a). This hence indicates that government involvement is one of the most influential

factors propelling the initiation of green retrofits. Moving forward, given an increase in tariff for the consumption of water and electricity by 23% and 34% respectively in Abu Dhabi from the year 2017 (Dajani, 2016), the ability to lower energy consumption can well offset the rise in utility costs and allow for additional savings and profits. A real-life example is Dnata Freight's warehouse – which is the first ever carbon-neutral warehouse in Dubai. The said facility without changes in its existing requirement for lighting reduced its energy consumption by 19% through the installation of energy-efficient lighting lamps (Bardsley, 2009). Where a landlord is faced with a decision to continue using the existing building stock or create new developments, then as suggested by (Davies and Osmani, 2011), the application of tax on new construction projects does marginally affect the net profit rate. Given the implementation of value-added tax (VAT) in January 2018, landlords must anticipate a gradual increase in construction and material building costs as suggested by (Abdel-Razzaq, 2017). Where capital costs for new development are of much importance, then as indicated by Sawchuck (2009), utilization of low-priced outdated or new unapproved VOC emitting materials, furniture and office equipment may contribute to sick building syndromes amongst the end-users. On the other hand from a sense of Corporate Social Responsibility (CSR), re-usage of a building can enhance company image and become a marketing tool to establish the commitment of an organization to act sustainably and thus retain existing clientele and draw potential customers (Kok and Jennen, 2012). The importance of a CSR can be backed up based on a survey conducted by the Ministry of Environment and Water – U.A.E to assess the contributions of financial organizations towards a green economy. The results revealed 46% of respondents suggesting that CSR is the top reason for the adoption of green practices. Also, a green retrofit improves indoor air and environment quality levels lower sick-building syndromes and thus absenteeism of employees (Sawchuck, 2009).

2.2.3 Barriers of green retrofitting

Given several advantages of retrofitting seen in the form of decreased energy usage and emission of greenhouse gases, its adoption faces numerous barriers in the form of financial, technical and social aspects in private buildings. Considering the U.A.E. built environment, the cost of refurbishment is seen as the first barrier for a green retrofit. As

suggested by (Surendar 2016b), government investors such as National Bonds are seen to provide funds for retrofit of government buildings. However, due to an absence of collateral in private buildings, a great deal of reluctance is seen amongst financial institutions for the provision of funds to such buildings. Jagarajan, Abdullah Mohd Asmoni and Lee (2015) suggested that initial capital costs, changes in the pricing of green materials and lack of funding further contribute towards the financial barrier of retrofitting. Furthermore, (Marker, Mason and Morrow, 2014) suggests that over 50% of barriers to green retrofitting is owed to unattractive returns on investments. For instance, the replacement of an air-cooled to a water-cooled chiller in the head office of DEWA in 2015 is anticipated to provide the ROI within 6-7 years (Surendar, 2016b). Sutherland (1991) acknowledged that investments towards energy conservation are viewed as being "illiquid" and "high-risk transaction cost" for tenant-occupied buildings. As suggested by Adnan Sharafi, Chairman of Emirates Green Building Council – U.A.E., building owners feel discouraged to implement high-cost energy saving initiatives because utility costs are paid by the end-users.

Secondly, the lack of awareness amongst senior management is an example of the barriers mentioned above. FM operations are treated as non-core activities of the organizations that generate costs (McLennan, 2000). From the Nigerian built environment, (Ikediashi *et al.*, 2012) learnt that lack of awareness and commitment by the senior management is a key barrier that can discourage the ideology of green retrofitting. Where the design of an existing facility is concerned, (Chidiac *et al.*, 2011) assert that, existing physical properties and operational features of MEP assets must offer adequate flexibility to implement changes associated with retrofitting. Reed and Wilkinson (2005) added that unsatisfactory building quality can lead to high costs, thus raising doubts on the viability of retrofitting in comparison to new development.

2.2.4 The process of a green retrofit

A green retrofit addresses operational facets such as existing pattern of energy consumption and water, waste production and indoor air and environmental quality levels (Aaltonen *et al.*, 2013). It can be hence suggested that, the facets of a green retrofit hold

relevance to the O&M stage of the building lifecycle. Aboulnaga (2013) asserted that, the practices and responsibilities of Facilities Management during the operation phase can lead to transformation of a conventional building to a green building. Benefits are seen through extension in useful lifecycle of the existing facility at reduced operational costs, healthy working conditions and comfort levels to thus enhance productivity levels of end-users and have a reduced impact on the environment through a decrease in usage of energy (Mawed et al., 2014).

2.3 Role of facilities management at the operational stage

For the U.A.E. to continue meeting its infrastructure needs without compromising on sustainability, the government launched the 'Green Growth Strategy' initiative to encourage implementation of greening efforts within both public and private sectors.

As suggested by Rybkowski *et al.*, (2017), FMs have a potential role in decreasing adverse effects of the built environment. The growing importance of FM has led to the formation of organizations such as MEFMA, IFMA and BIFM that strive to continually train and enhance the skill set of FMs in the GCC countries.

Also, this is a list of services delivered by FM during the operational phase of any given projects:

- Maintenance and management of resources
- Flexibility of buildings
- Ergonomics
- Planning and strategizing for future needs
- Environmental management and energy enhancement

The role of facilities management in green retrofitting is fundamental since an approximate 80 to 90% of environmental impacts are associated with operations of existing buildings. Broadly speaking, facilities management conduct the process of energy enhancement and these fall under three categories. A "basic retrofit" that focuses on low-cost energy-enhancement initiatives, followed by "standard retrofit" that focuses on enhancing the building envelope and the last being, a "deep retrofit" that concentrates

on capital-intensive initiatives that are deemed to yield the best form of savings (Dubey and Krarti 2017).

In lieu of the highlights and discussions so far on the concept of green retrofitting, the section below comprises of several sustainability initiatives that are implemented by FM as part of green retrofits in the U.A.E.

2.3.1 Energy conservation

Lighting, for instance, is considered a great achievement in the process of energy conservation. Referring to the Dubai Chamber headquarters (DCHQ), the FM team installed CFL and LED (Light-Emitting Diode) lamps led to a decrease in lighting loads. An equivalent decrease in lamp heat emissions provided additional savings of 100,000kWh/year. A corresponding reduction in cooling loads allowed to operate one chilled water pump instead of four (Madani 2012). Likewise, from a case study of Yas Viceroy Hotel, Abu Dhabi, the FM team proceeded with the replacement of the conventional 70watts halogen lamps replaced by 8watts LED lights to achieve 87% of energy savings (Withers, 2014).

Besides lighting, FM can potentially conserve energy in HVAC operations of an existing facility. With ambient temperatures between 20-22 deg. C, the FM team at DCHQ maximized fresh air intake within interior spaces, to thus switch off the chillers during the winter season. Through good FM practices and technical competency, the optimization of the existing Building Management System and temperatures adjustments of all interior spaces to 24 deg. C allowed the permanent shutdown of five from eight chillers (Madani 2012).

Similarly, the FM team of Dubai Festival City adjusted frequencies of chilled water pumps, recalibrated differential pressure switches of air handling units and fan coil units, installed additional metering devices and intermediated operation of the extract fans to obtain yearly savings of AED 3,566,000 (Alkhateeb et al. 2016).

2.3.2 Water conservation

Water systems are also regarded as an effective area for energy conservation. Assaf and Nour (2015) suggested that the upgrade of existing faucets and other plumbing fixtures with low-flow fixtures can bring about a considerable amount of savings. The FM team of "Archcorp architectural engineering", Dubai, witnessed an 89% decrease in water consumption through the installation of low-flow mixers having flow rates of 1.58 GPM against the standard 2.5GPM. Annual consumption was reduced from 102,623 I.G. to 8,663.23 I.G. (Alkhateeb and Hijleh, 2017)

2.3.3 Materials

Yet another crucial role of FM in a retrofit is seen in the procurement of materials. As suggested by (Cabeza *et al.*, 2014), FM adopts a whole lifecycle methodology for choosing materials that carry low-embodied energies and can be recycled along with other properties such as durability, high usable life and minimum need of maintenance to therefore decrease overall building carbon emissions.

The overall aim of this paper is to provide an overall insight on factors that govern the process of green retrofitting and current practices utilised by facility managers in managing and enhancing the environmental status quo of existing facilities in the U.A.E.

3.0 Research Methodology

In order to develop an understanding on the growing importance of sustainable development and how a green retrofit can improve the environmental, social and economic elements of existing facilities, the research commenced with an explorative approach which led to formation of a literature review and hence provide insights on drivers that govern overall process of a green retrofit and role of facility managers in its execution. Since this study focuses on understanding both current status quo of green retrofit in existing buildings and factors that govern its implementation, it seemed imperative to conduct a preliminary investigation and obtain views of FM professionals from the U.A.E. built environment.

Where a quantitative approach yields statistical results, (Sankar *et al.*, 2006) suggests that a qualitative approach allows answers to open-ended queries aimed at human and social

issues with the motive of defining and understanding viewpoint expressed through words of the respondent.

The method adopted to collect primary data comprised of onsite visits to meet and conduct personal interviews with prominent professionals from the local FM industry with their respective job roles and characteristics similar in nature.

Interviews aim to elicit a deeper understanding of current FM practices, including cost-effective methodologies deployed towards enhancing the current status quo and challenges faced in operability and maintainability of an existing facility. Referring to a list of registered corporate members of MEFMA, eight FM professionals employed with renowned real-estate developers managing in-house and outsourced contractors were chosen. One of the respondents holds a 'directorial' position, five respondents hold 'managerial' positions and the remaining two respondents hold an 'engineering' position. The chosen set of respondents hold vast knowledge of green building practices. It was agreed that response and overall feedback from each of the respondents would be kept confidential to preserve their identity in the local FM industry. The chosen format of the interview was ‘semi-structured’ with questions prepared in a manner that would enable a two-way discussion channel with the leverage of probing further questions to yield the best possible answers. The questions were predetermined and shared with the respondents prior to the scheduled date of the interview. The scope of the interview concentrated on understanding the technical and non-technical factors that govern the implementation of a green retrofit and its potential in fulfilling the social, environmental and economic elements of sustainable development in comparison to demolition and construction of a new facility. Furthermore, the interview also aimed at developing an understanding of the competencies of FM professionals in enhancing the sustainability aspect of existing buildings. The qualitative data generated from the interviews were analysed using the categorizing approach to encode and assemble data obtained and thereby relate it to the objectives and aims of this study.

The second stage of this was also based on a qualitative approach. (Yin, 2003) suggests that case studies yield an in-depth analysis of a given problem and further support suggestions and arguments drawn from an individual or a group. With this said, the second and last stage of this paper aims at assessing information obtained from the

literature review and responses from interviews for validation against an actual case study and therefore examine the role of facilities management in a green retrofit and its current status in the U.A.E. built environment.

4.0 Results and discussion

4.1 Interviews

The interviewees were initially screened through the usage of the platform LinkedIn, to determine their overall experience in managing facilities and degree of involvement in green retrofit projects to thus ensure responses received are substantial to the scope of this research. Lastly given the limited size of the local FM industry and personal networking, 'word of mouth' did benefit in selecting the most appropriate respondents.

Table 1 - Interviewee Details

Respondent	Certifications	Working Experience	Position in the Organization
A1	FMP	18 years	Senior Facilities Manager
A2	LEED AP	15 years	Facilities Manager
A3	FMP	13 years	Senior Facilities Engineer
A4	LEED Green Associate	20 years	Director of Facilities
A5	CFM	11 years	Facilities Manager
A6	BEng. in Mechanical Engineering	7 years	Facilities Engineer
A7	LEED	9 years	Assistant Facilities Manager
A8	FMP	12 years	Assistant Facilities Manager

Based on the outcome of the semi-structured interviews, the data obtained provided an in-depth understanding on the perception of green retrofitting of existing facilities in the built environment of the U.A.E. The section below shows the interview questions and

corresponding answers that were obtained from the aforementioned respondents. The answers for each question are then analysed and discussed in a detailed manner.

Table 2 – Responses collected from the interviewees

		Respondents							
Question	Response	A1	A2	A3	A4	A5	A6	A7	A8
Drivers of green retrofitting	Enhanced brand image				•	•			
	Counteract competition			•			•	•	•
	Government-led initiatives	•	•		•	•		•	•
	Improved IAQ/IEQ		•	•					
	Reduction in operational costs	•	•						
	Corporate social responsibility (CSR)				•	•			
	Good IAQ and IEQ		•	•					
Current practices of green retrofitting	Implementation of low-cost initiatives		•	•		•	•	•	•
	Good FM practices		•	•		•	•	•	•
	Sustainable procurement practices	•							
Barriers towards retrofitting	Low ROI	•			•	•		•	•
	Inadequacy in financial support	•	•				•	•	•
	Design constraints			•			•		
	Stakeholder commitment			•		•	•	•	
	Team competence			•			•		
	Implementation of VAT		•						
Suggestions to overcome such barriers	Staged investments for smaller ROIs	•	•						
	Capital investment by an ESCO	•							
	Communication with stakeholders	•	•	•	•			•	•
Benefits of retrofitting	Enhanced productivity and wellbeing					•	•		
	CSR	•	•		•				
	Reduced environmental impacts	•						•	•
	Enhanced company image	•	•	•	•				
Role of FM in the future of green retrofitting	Raise awareness amongst stakeholders	•	•		•	•			•
	Effective metering		•	•					
	SLAs and KPIs for energy conservation	•			•				

4.2 Drivers of Green Retrofitting

With reference to table 4, the concept of green retrofit has gained momentum due to various drivers such as 'Government Initiatives', 'Return on Investment', 'Corporate Social Responsibility', 'Increasing Competition', 'Reduction in Operational Expenses' and 'Good IAQ and IEQ'. The open-ended answers were grouped under several segments: community, economic and external drivers.

Based on a common viewpoint, 'Government Initiatives' came across as the leading driver for having uplifted status quo of green retrofits in existing facilities. This is understandable given the launch and implementation of several government initiatives such as Demand Side Management programme by Dubai Supreme Council of Energy, DEWA initiatives to retrofit its own buildings and the mandatory retrofit of public buildings.

'Increasing Competition' together with 'Reduction in Operational Expenses' ranked as the second and third drivers for a green retrofit. With the prevailing agenda of global warming amongst local communities and clients who are hence seen to prefer sustainable and energy-efficient housing, respondents A3, A6, A7 and A8 revealed that landlords face fierce competition to retain and attract prospective clients for renting existing facilities. Respondent A3 expressed that: "The primary intention of a green retrofit is achieving energy savings during stringent market conditions in order to offset both the drop in rental values and demand amongst the local population".

From a deeper commercial perspective, respondents A1 and A2 asserted that 'Reduction in Operational Expenses' is one of the critical factors for a business to reduce its overheads and maintain profit margins. Both respondents also perceive retrofitting as a means of increasing prestige of an existing facility through the acquisition of a LEED certification and thus counteract competition in an industry which is witnessing the delivery of several new sustainable developments as part of the upcoming EXPO 2020. Moving towards a business perspective, respondents A4 and A5 emphasized on criticality and fulfilment of 'Corporate Social Responsibility' to hence ensure landlords retain their brand image and meet the changing needs of clientele. Lastly, respondents A2 and A3

suggested the importance of enhanced air quality levels, controllable temperatures and natural light as a means to lower sick-building syndromes and absenteeism of staff. ‘Good IAQ and IEQ’ came across as the fifth driver for a green retrofit.

4.3 Current Practices and Barriers for Green Retrofitting

Talking about current practices and attitude towards green retrofitting, majority of the respondents suggested that ‘Good FM Practices’ and implementation of low-cost energy and water conservation techniques are current practices to narrowly conduct green retrofits in existing buildings. Respondent A6 suggested that the application of basic lighting and plumbing retrofit opportunities have gained immense popularity amongst landlords owing to low-capital cost and quick return on investments.
Touching on the procurement of energy-saving materials, respondent A1 emphasized that procuring eco-friendly and sustainable materials is a significant element of a green retrofit.

On the contrary, respondents A5, A7 and A8 expressed that, the quantum of benefits from ‘Good FM practices’ and low-cost sustainable initiatives is generally minimum-to-moderate. Initial moderate-to-high capital investment is essential for realizing both short-term and long-term benefits of a green retrofit. From an in-depth commercial perspective, respondent A4 revealed that with the upcoming EXPO 2020 and increasing competition in the real estate market, long-term operating budgets, ROI and savings in cost are critically evaluated for any capital expenditure. Furthermore, landlords have little incentive for comprehensive retrofits as utility charges are paid by the end-users.

Evidently, more than half of the U.A.E. economy comprises of expatriates, and the private residential sector sees a tenant-landlord relationship with utility costs borne by the end-users. There hence lies minimum opportunity to take high-end initiatives in the improvement of the facility. Providing further insight, A1 suggested that the return on investment and attractive pre-guaranteed economic incentives are keys to gaining approval for a retrofit irrespective of the stakeholders' good environmental intentions.

All four responses emphasized on ‘return on investment’ is the heart of any investment. In order to counteract the aforesaid barrier, A2 suggested the exercise of staged investments that offer the flexibility to undertake refurbishment in phases carrying shorter ROIs. A1 held a similar response and further asserted that such a task would induce a change in perception held by owners.

On the contrary, based on feedback received from A3 and A5, lack of awareness on sustainable practices and hence ‘commitment’ amongst senior management also impedes the process of a green retrofit. A3 suggested that a certain degree of technical knowledge and involvement of landlords is necessary to receive their support during challenges that may be encountered during a green retrofit.

Holding similar sentiments due to lack of commitment by stakeholders, A5, A6 and A7, expressed their respective roles to be perceived as cost-generating individuals who are responsible for ensuring the upkeep of the facility. Operational budgets were suggested to be dependent on the year-on-year revenues, which thus indicating the inadequacy of capital budgets and disabling the implementation of several moderate-in-cost initiatives. Contributing further, respondent A2 stressed upon the application of VAT has had owners become more cautious on expenditure. According to A4, given difficult market conditions, banks are more careful in granting funds. The local government should devise funding schemes that can encourage landlords to undertake extensive retrofits. This step shall witness the U.A.E. to address the challenge of global warming.

When considering the age of assets and overall structure of a facility, global competence in the local FM industry may then come across as a concern. Respondents A6 and A3 expressed a lack of skilled and specialized labour in the U.A.E. market for an extensive green retrofit.

A6 revealed that due to inadequate flexibility in the existing design of a structure which would hence require a high level of expertise, the capability of our technical team is limited to the implementation of basic energy saving initiatives in terms of lights and water. Extensive courses and training are necessary to educate the team on green building practices.

Supporting the feedback received from A6, respondents A1 and A2 suggested that the retrofitting market is relatively new and reluctance amongst building owners for incurring high capital costs hence seems justifiable. A1 shed light on the current status of the retrofit market by stating that several new ESCOs are believed to be willing to sign a performance-based contract and provide all capital investments for the building enhancement. The owner is thus not required to bear any costs. The investment shall then be recovered over the contract duration through savings in utility expenditure.

All interviewees touched upon the importance of the financial aspect of a retrofit. 'Return on investment' is the first and crucial barrier to undertaking a retrofit. The positive aspect of any change is instantly negated, where there is a lack of commitment and support. All interviewees did generally agree that the involvement of all stakeholders from the higher management down to the end-user is crucial in realizing the benefits of a retrofit irrespective of the size. Where the aforesaid barriers focus on the financial and management aspects, a third barrier is seen in the form of inflexibility and ageing of the facility that may hinder the implementation of extensive retrofit initiatives. The fourth barrier falling on the competence levels of the team seemed resolvable through adequate training.

4.4 Benefits other than energy savings

With energy savings and reduction in operational costs being one of the most after sought benefits of green retrofitting, then from a strategic viewpoint 'enhancement of company image' ranked as the second benefit of retrofitting that can offset competition. A1 claimed that acquiring a green building certification and can enable an organization being recognized as socially conscious. The ability to fulfil a 'corporate social responsibility' and 'minimize environmental impacts' were the third and fourth perceived benefits of retrofitting. A7 and A8 together highlighted the environmental benefits. In considering the construction of a new sustainable development against an existing facility, the idea of demolishment was perceived as being a counter-productive approach to the concept of energy conservation. Green retrofitting is believed to potentially increase the lifecycle of the facility, minimize GHG emissions and provide a healthy internal and external environment. With little importance, A5 and A6 believed that 'improved IAQ and IEQ'

could provide healthy working conditions and comfort levels to thus enhance productivity levels of the workforce.

4.5 Role of facilities management in the future of green retrofitting

Majority of the interviewees acknowledged that it is the task of FM to set up one-to-one interaction with key decision makers and gain their confidence for initiating a green retrofit. A2 and A3 suggested effective utility metering that would allow compiling accurate databases of past and current trends of energy consumption and benchmark enhancement in energy usage. This is deemed essential to justify the concept of retrofitting to senior management.

A1 and A4 suggest that standard TFM contracts require the service provider to “maintain the asset for no breakdowns”. However, a shift in focus to “maintain the asset and reduce carbon emissions” must take form through a choice of appropriate SLAs and KPIs that place an obligation on contractors for decreasing operational emissions.

5. Case study

In order to assess information obtained from the literature review and responses from the interviews, an in-depth case study of a commercial and residential facility in the U.A.E. was selected for further evaluation of the role of FM in green retrofit. Being a subsidiary of a UAE-based private developer, the subject commercial and residential facility has acquired a LEED Existing Building (EB) O&M "Silver" certification after achieving credits under seven categories such as “Sustainable Sites”, “Energy and Atmosphere”, “Water efficiency”, “Materials and Resources”, “Indoor Environmental Quality” and “Innovation in Operations” and "Regional priority".

Table 3 below shows the LEED EB O&M criteria and overall influence of FM on achieving the required credits. A discussion is then provided in the next chapter combining both the interview and case study findings.

Table 3 – LEED scorecard of the subject case facility

LEED for Existing Building: Operation + Maintenance V3.0		
Case Facility: - A government-owned building		
Certification Awarded: - Silver	**56/110**	
Categories	**Score**	**Role of FM**
Sustainable Sites	10/26	A decrease in 'urban heat island effect'
Water Efficiency	8/14	Optimization in water consumption
Energy and Atmosphere	18/35	Enhanced O&M practices Low-cost energy saving initiatives
Materials and Resources	5/10	Sustainable procurement practices Enhanced waste management practices
Indoor Environment Quality	8/15	Green policy and frameworks for cleaning operations
Innovation	5/6	Implementation of SFG20 standards and overall good FM practices
Regional Priority	2/4	Enhancement of sustainability in MEP operations

5.1 Role of facilities management in the project's green retrofit

Under 'Sustainable Sites', the FM team installed a low-VOC green mat on the rooftop followed by the installation of reflective shades in the external parking spaces. This together decreased the 'urban heat island effect'. Furthermore, presentations were conducted to encourage employees to use public transportation vehicles. A 23% decrease was achieved in the conventional usage of vehicles.

Under 'Water Efficiency', low-cost initiatives such as the installation of water aerators and other efficient plumbing fixtures also enabled achievement of credits under 'Regional Priority'. Existing water flowrates were reduced by 20 million gallons a year equivalent to 40% reduction against the previous year.

Under 'Energy and Atmosphere', implementation of good FM practices, recommissioning and recalibration of existing BMS and MEP equipment together with the enhancement of existing maintenance procedures under the guidelines of SFG20 standards also enabled fulfilling credits under 'Innovation'. Existing light fittings carrying Lighting Power Density (LPD) of 3.0 Watts/square feet were replaced with energy-efficient LED lights to achieve an enhanced lighting level by 70% coupled with a reduction in 30% of electricity consumption.

Under ‘Material and Resources’, the formation of an Eco-friendly Preferable Purchasing (EPP) policy has led to the procurement of sustainable materials from vendors who conform with local legislative requirements. Lifecycle assessment and consideration of future environmental impacts are prerequisites during the purchase of materials.

Under ‘Indoor Environment Quality’, eco-friendly certified chemicals and materials are procured for site operations. The internal quality checks and assessment of cleaning performance were attuned as per LEED standards. A building specific, green cleaning policy and frameworks were devised for cleaning operations. The technical team modulated existing ventilation levels of the HVAC system to thus comply with the prerequisite of ‘Minimum IEQ’.

6. Discussion

Looking at the interview findings, a combination of good FM practices and application of low-cost sustainability initiatives were seen as crucial responsibilities of FM in uplifting sustainability quo of existing buildings. Interviewees expressed the disability to implement several moderate-to-high cost retrofit initiatives. In the subject case study, the emphasis was directed towards implementing low-cost initiatives, and the FM team expressed dissatisfaction towards budget constraints. Understanding barriers that opposed an extensive retrofit in the case study, the facilities manager expressed conflicting viewpoints between the FM department and building owner on long-term cost and energy savings. Similar feedback from the interviewees indicates that irrespective of the building age, condition and design constraint of an existing building, private building owners hold a short-sighted view of a facility and low capital costs are favourable. A further challenge is seen where end-users pay consumption bills thus diminishing the motivation amongst landlords for intensive metering and energy reduction. This is cognate with the case study findings wherein sustainability initiatives were limited to the common areas. Considering the case study and where initiatives were applied on a small-scale basis, the FM praised the commitment of the senior management and hence the availability of budgets that led to the successful completion of the project.

Talking about drivers in the case study, factors such as ‘corporate social responsibility’, ‘corporate image’, ‘existing IEQ’ and ‘operational costs', all led to the initiation of the retrofit. The drivers suggested by the interviewees are along the same line.

Talking about the role of FM in retrofitting, the green retrofit program that led to acquiring the LEED certification saw the in-house FM team apply green O&M practices towards the usage of energy, water, material and IAQ and IEQ levels. However, given a fine line between sustainable FM practices and low-cost retrofit initiatives as seen in the case study, it is difficult to comment which of the enhancements are attributed to a low-cost retrofit initiative or is part of just good FM practice. This is said, owing to the fact that FM practices and its functional outputs meet the majority of the criteria of a green building rating system. Based on feedback from the interviewees and case study findings, the successful execution of any green retrofit project requires planning, effective communication between FM and project stakeholders and most importantly, commitment from the senior management towards the achievement of common goals and benefits. The retrofit program of the chosen case study involved a great deal of commitment and willingness of the senior management that thus enabled the FM team to implement multiple retrofit initiatives.

7. Conclusion

This study provided insight into existing practices and the contribution of FM towards a green retrofit project. Through consideration of the case study and interview, the current practices towards enhancing sustainability in the existing buildings has seen to have gained minimum-to-moderate momentum. Where a government mandated compliance for green retrofit in existing buildings is yet to be seen, ‘reducing operational expenses’, ‘enhancing brand image’, achieving a green building certification, fulfilling 'corporate social responsibility' and maintaining a competitive edge in the industry were seen as the key drivers that have encouraged building owners to reap benefits of green retrofits in existing private buildings.

The implementation of a 'deep' retrofit is mainly hindered by the initial capital investment. The problem is far more significant in leasehold buildings where electricity consumption charges are paid by end-users. With the retrofitting market being relatively

new, a reluctance amongst UAE-based international banks in granting funds and absence of funding schemes by the local government further contributes to the agenda of financial aid for retrofitting of private buildings. Government legislation, coupled with incentives, must be introduced to motivate property owners to shift focus towards enhancing sustainability. On the contrary, several new ESCOs are venturing into the U.A.E. market and willing to incur initial investments, share savings with the building owners and obtain returns on the investment. However, irrespective of the retrofit strategies and financing options available, the practice of introducing a change is usually hindered by human factors. The literature review and responses of the interviewees suggest that the senior management are yet to realize the importance of a green retrofit. An adequate level of awareness and the importance of sustainable practices amongst decision makers is mostly dependent on FM professionals who must establish effective communication channel with senior management.

With low rates of replacing existing buildings, the overall literature followed by findings of the case study and interview suggests that, competency and experience of facility managers in applying good FM practice for the overall O&M of assets and implementing low-to-negligible sustainability initiatives positively influence on the existing performance standards of the building. FM professionals are well equipped and competent in greening existing buildings and can simultaneously lead a building to the path of acquiring a green building certification.

Like various other research studies, a certain degree of limitation is involved in this research. The first limitation is that the interviewees work for the private residential and commercial building sectors. With the concept of retrofitting greater in government buildings, some data findings may be accompanied by a negligible degree of uncertain knowledge. The second limitation being, results of this study may not necessarily be extendable and implied to the status of green retrofitting in private buildings of other developed countries.

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